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## Topographic Map of the Active Part of the Slumgullion Landslide on July 31, 2000, Hinsdale County, Colorado

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## **Introduction**

The active part of the Slumgullion landslide, located in the San Juan Mountains of southwest Colorado (fig. 1), moves throughout the year (Coe and others, 2003) and has probably been moving for about the last 300 years (Varnes and Savage, 1996). Because the landslide is continuously moving, the topography of the landslide is continuously changing. The topography of the landslide was previously mapped using aerial photographs taken in 1985 (1:12,000-scale photographs, see Powers and others, 1992, for description of unpublished map) and 1990 (1:6,000-scale photographs, see Fleming and others, 1999, for map). These topographic maps, as well as digital elevation models derived from the maps (Powers and others, 1992), were used for numerous scientific studies of the landslide in the 1990s (e.g., Powers and Chairle, 1996; Smith, 1996; Baum and Fleming, 1996; Fleming and others, 1999). Ongoing studies that began in 1998 (see Coe and others, 2003) require knowledge of current topography. This paper presents a 1:1,000-scale topographic map of the landslide (sheets 1-4) that was made from aerial photographs taken on July 31, 2000.

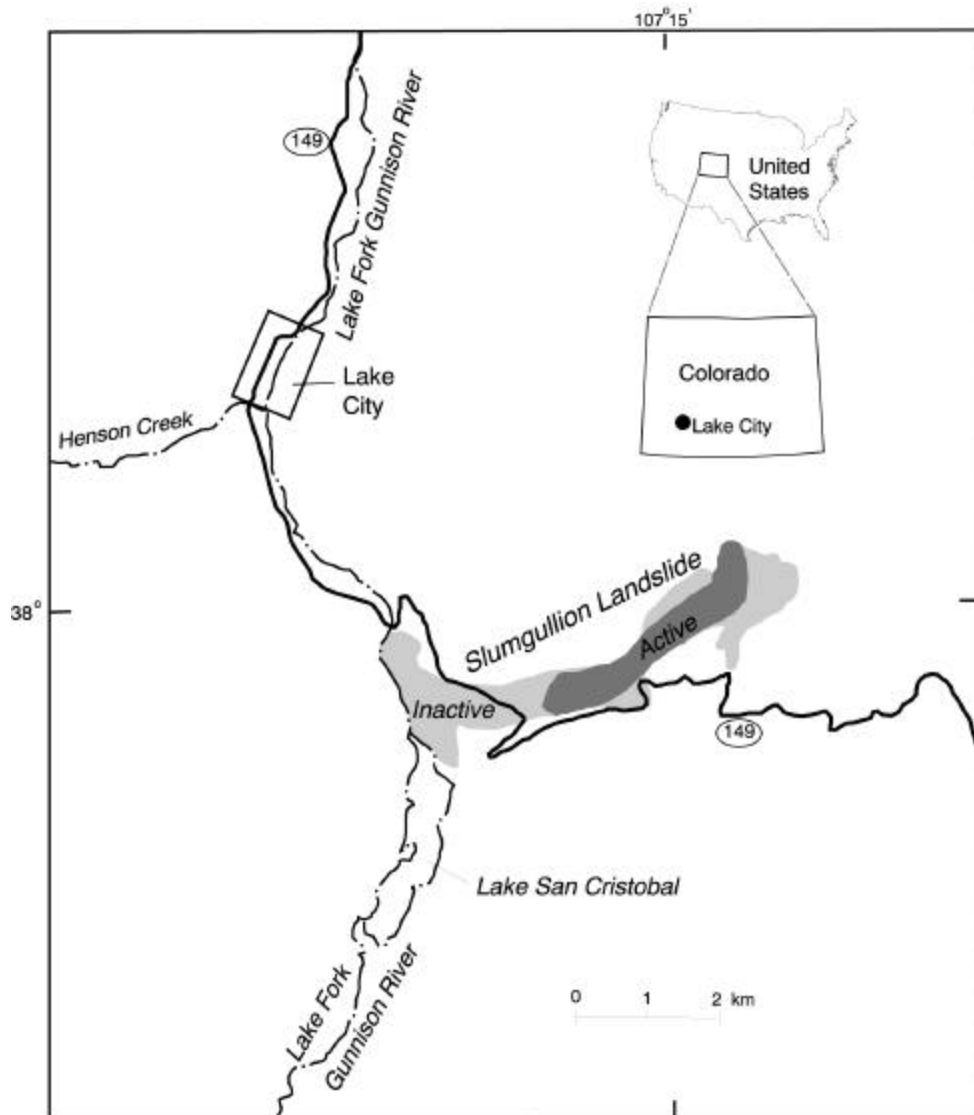


Figure 1. Map showing active and inactive parts of the Slumgullion landslide.

### **How The Map Was Made**

The topographic map (sheets 1-4) was made using a Kern DSR-11 analytical stereo plotter (Chapius and van den Berg, 1988) and 1:6,000-scale stereo aerial photographs taken by Intrasearch, Inc. on July 31, 2000. Forty control points were used to register the photographs to the ground (fig. 2). Nineteen of the points were on non-moving ground and served as the primary control points to register the photographs.

Twenty-one of the points were on moving ground and served as supplemental control points (usually for elevation control only). The control points were surveyed by rapid-static GPS survey on July 24-26, 2000. The positions of all the points were surveyed in the World Geodetic System 1984 with heights given as ellipsoid heights (see Van Sickle, 1996). Prior to using the points to register the photographs, the point positions were transformed and projected (using Prism v. 2.1 software by Ashtech, Inc.) into the Colorado State Plane (southern zone) coordinate system with heights converted to elevation above mean sea level in the North American Vertical Datum of 1988 (table 1). Therefore, coordinates shown on the map are in the Colorado State Plane coordinate system and heights are elevations above sea level. All units shown on the map are meters. The contour interval is 2 m. Previous topographic maps of the landslide are in a local coordinate system (fig. 2) established by David Varnes in the early 1990s (Varnes and others, 1996).

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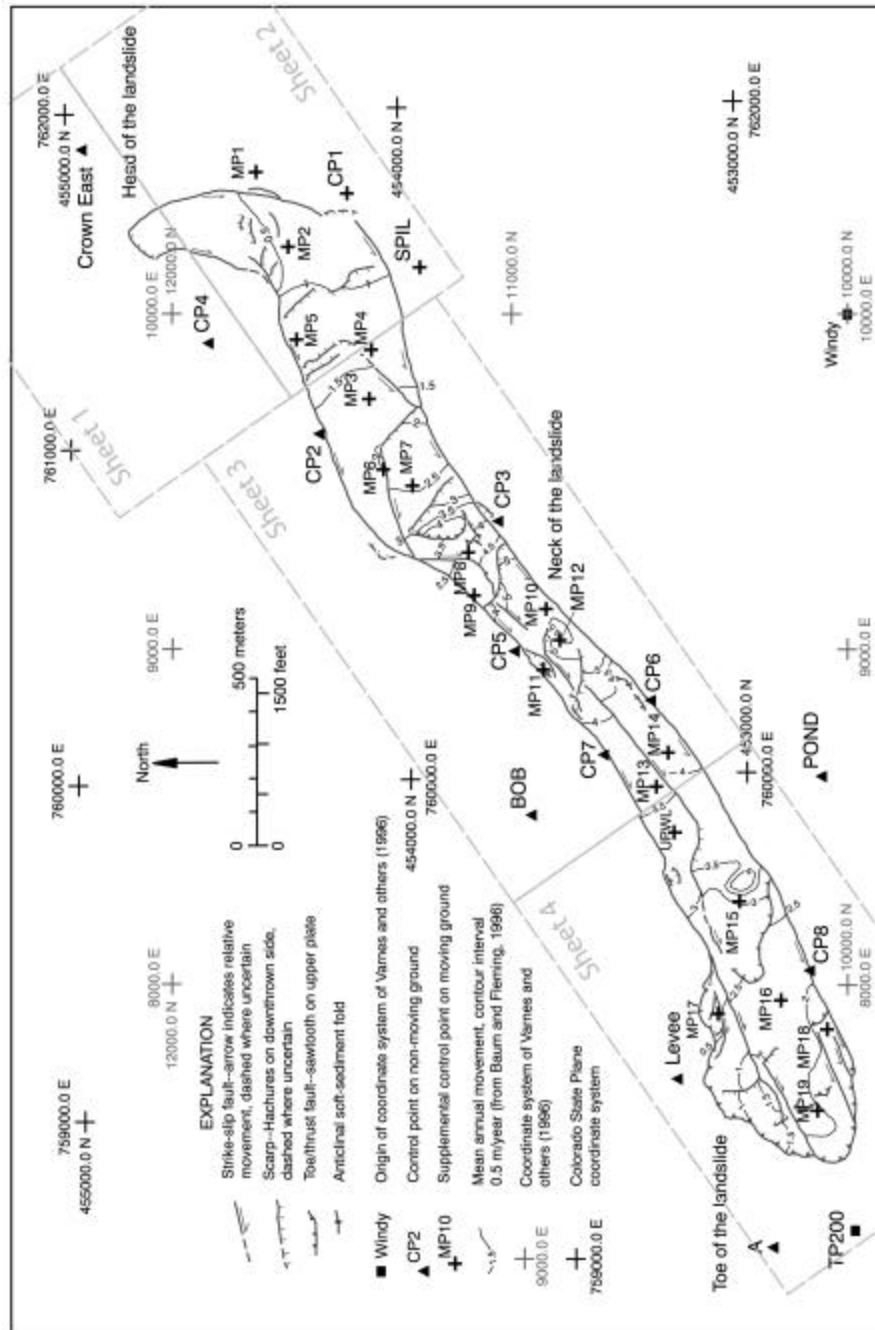


Figure 2. Active part of the Slumgullion landslide showing structural elements, contours of mean annual movement, and control points used to register aerial photographs. Approximate location of topographic map sheets is also shown. Modified from Baum and Fleming (1996) and Coe and others (in press).

Table 1. Control points used to register aerial photography taken on July 31, 2000. Note that some of these points are not shown in figure 2 because they lie outside the area shown on the figure. A) Points located on non-moving ground. B) Points located on moving ground.

A.

Point	Easting (m)	Northing (m)	Elevation (m)
TP200	758624.74	452715.06	2945.21
CROWN EAST	761899.34	454937.10	3719.98
LEVEE	759092.91	453223.59	3002.67
CP2	761037.12	454246.82	3346.03
CP3	760760.79	453720.33	3295.52
CP4	761314.63	454567.92	3526.18
CP5	760376.93	453680.54	3237.13
CP6	760215.72	453282.78	3173.66
CP7	760060.76	453422.54	3165.14
CP8	759405.93	452829.54	3044.51
A	758579.47	452953.54	2958.97
SPIL	761510.31	453890.34	3421.55
SADD	762406.23	453658.31	3502.79
VIEW	762416.81	454314.71	3533.66
BOB	759886.45	453609.55	3266.83
SWITCH	758049.43	452152.90	3004.62
FERD	756817.27	454056.47	2696.89
POND	760013.78	452750.54	3085.66
TWIN	757994.87	453420.13	3009.94

B.

MP1	761816.78	454426.35	3447.34
MP2	761594.24	454334.00	3426.24
MP3	761131.58	454100.57	3351.97
MP4	761281.10	454092.85	3367.54
MP5	761315.00	454309.04	3399.46
MP6	760920.39	454055.24	3334.77
MP7	760874.63	453976.57	3321.38
MP8	760662.88	453810.23	3276.77
MP9	760538.86	453795.26	3267.85
MP10	760492.95	453581.18	3233.45
MP11	760310.89	453597.57	3207.50
MP12	760396.17	453544.84	3218.65
MP13	759953.29	453269.19	3140.65
MP14	760053.71	453229.86	3154.40
MP15	759605.87	453032.55	3083.86
MP16	759309.95	452920.83	3040.19
MP17	759281.46	453106.43	3038.90
MP18	759224.68	452779.54	3026.01
MP19	758982.89	452818.25	3008.44
CP1	761747.06	454149.73	3436.03
UPWL	759832.76	453219.50	3113.95

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